PLANT-LIFE IN KRAKATAU AND THE MEXICAN DESERT.[1]

ENGLISH readers owe a debt of gratitude to Prof. Seward and the Cambridge Press for an English edition of Prof. Ernst's account of the re-colonisation of Krakatau. It is five-and-twenty years since Krakatau and the neighbouring islands in the Sunda Strait between Java and Sumatra were transformed by the most violent volcanic outburst of historic times from forest-covered islands to deserts of pumice and volcanic ash. Long regarded as an extinct volcano, Krakatau, in the early summer of 1883, resumed activity, and towards the end of August the eruption culminated in an outbreak the effects of which were felt over almost the whole of the earth's surface. For a distance of twenty-two miles neighbouring land was covered with glowing stones and hot ashes, and it is estimated that the finer dust was spread over an area of some 234,000 square miles. As a result of this enormous loss of material, a large portion of the island fell in, and the Krakatau of to-day is less than half the size of the island of 1883, and has a quite different outline.

The islands therefore afforded an unprecedented opportunity for studying the development *ab initio* of the organic population of an oceanic island which rose several thousand feet above sea-level. The nearest land, the islands of Sebesi and Seboekoe, themselves half destroyed by the effects of the eruption, is twelve to fifteen and a half miles distant; the nearest points of Sumatra and Java are twenty-two to twenty-eight miles distant. Krakatau, the largest of the three islands affected, consists of the peak Rakata, 2700 feet high, which, on the north side, towards the disappeared portion of the island, forms an almost vertical wall, but on the south-east slopes steeply to a flat base in front of which is a small, level beach. In 1886, when Dr. Treub visited the island, its repopulation had already begun. Blue-green algæ, without doubt wind-borne, had formed a gelatinous layer on pumice and volcanic ash, and on the exposed rocks in the ravines on the mountain slopes; these formed a suitable nidus for the germination of wind-borne spores of mosses and ferns, as well as of seeds. Ferns preponderated at this early stage, being represented by eleven widely spread Indo-Malayan species; in the drift-zone of the beach were seedlings of nine phanerogams which had grown from sea-borne fruits or seeds; two of these were found in the interior and on the mountain slopes, with the addition of four species of Compositæ and two grasses, the fruits of which had obviously been brought by air-currents. Thus it was seen that the colonisation of an isolated high volcanic island does not proceed on the same lines as those of a coral island, where the elements of the strand-flora, brought by sea, are of the first importance. Here the wind-borne element played the principal part, and the flora of the interior had developed independently of the strand-flora, and with much greater rapidity.

It is to be regretted that more than ten years elapsed before the second exploration of the new Krakatau in March 1897. The number of species was then much increased, and amounted to fifty-three seed-plants and twelve vascular cryptogams; the ground was, in some cases, completely covered, and characteristic plant associations were forming; thus the *Ipomoea Pes-caprae* formation was a dominant feature on the beach. Further inland the vegetation constituted a kind of grass-steppe, the grass occasionally reaching a man's height and sometimes forming a thick jungle. On the hills and ridges were lower grasses with numerous ferns and a few seed-plants; ferns still predominated largely on the rock surfaces. Shrubs were few and trees rare. Of the fifty-three seed-plants it was estimated that thirty-two had come by sea, seventeen had been introduced by wind agency, and four by fruit-eating animals or by man. The results of a third expedition, in 1905, have not been published. In April 1906, was planned the short expedition of which the present is an account.

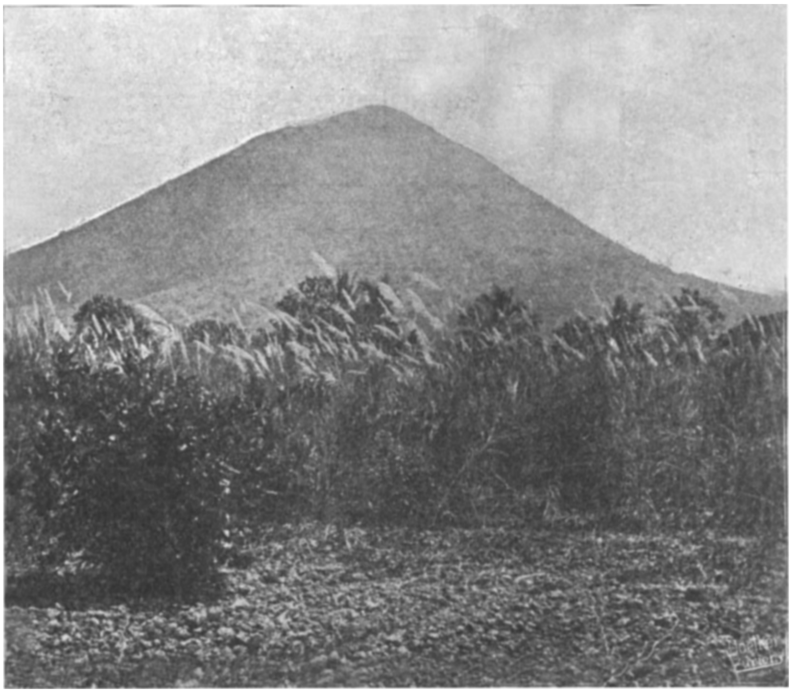

FIG. 1.—Clearing in the Strand-forest. To the left in the foreground *Scaevola Koenigii*; behind the grasses (*Saccharum spontaneum*) a group of coco-nut palms. South-east coast of Krakatau. From "The New Flora of the Volcanic Island of Krakatau."

The progress made by the vegetation since 1897 was remarkable; almost the whole south side of the island was seen to be covered with green. In the drift-zone on the beach was a great variety of fruit and seeds of land-plants, some quite fresh, some already germinated and rooted to the ground. They represent the widely distributed strand-plants which are the first colonists of recently formed coral reefs and islands, and owe their buoyancy to air spaces or light tissue in pericarp or seed-coat. Within the drift-zone was the low growth of the familiar *Pes-caprae* formation—long, trailing, rooting shoots of *Ipomoea Pes-caprae,* with runners of Spinifex forming a network with which was associated some low-growing leguminous species, and here and there tall grasses, sedges, and other familiar strand-plants. Beyond this a young strand-forest of trees and shrubs recalled the similar formation on the Javan coast. Most conspicuous were tall Casuarinas (*C. equisetifolia*), 40 feet to 50 feet high, while slender climbing plants, such as Cassytha, Canavalia, *Vitis trifolia,* and others formed an almost continuous mass of foliage. Among the trees, *Calophyllum Inophyllum, Terminalia Catappa,* and the beautiful white-flowered *Barringtonia speciosa,* which has given a name to this type of strand-forest vegetation, were conspicuous. Coco-nut palms, clumps of screw-pine (Pandanus), and large-leaved figs were also seen. Beyond the strand-forest a monotonous steppe-like vegetation of tall grasses and reeds, sometimes associated with climbing plants to form dense jungle, extended into the ravines and on to the steep sides far up on the cone. A deep ravine, rich in trees and shrubs, extending half-way up the slopes of Rakata, promised a rich botanical harvest, but, unfortunately, the party was unable to make a way through the thicket with the equipment and time at its disposal, and much of the flora remains, therefore, still unexplored. Nevertheless, the results bring the total number of species collected up to 137; the ferns have not materially increased in number, but the seed-plants have risen to ninety-two species. Of the strand-flora, two-thirds are species which are cosmopolitan on tropical coasts, and the plants of the interior are also cosmopolitan, or represent the commonest species which are widely spread over the old-world tropics. Nitrogen-fixing bacteria were found in abundance in the soil. As regards the means by which the islands have been colonised, it is estimated that of the seed-plants 39 per cent. to 72 per cent. have been brought by sea-currents, 10 per cent. to 19 per cent. by birds, and 16 per cent. to 30 per cent. by air-currents; air-currents are also responsible for the presence of the ferns and lower cryptogams.

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[1] "The New Flora of the Volcanic Island of Krakatau." By Prof. A. Ernst. Translated by Prof. A. C. Seward, F.R.S. Pp. vi+74; with two sketch-maps and 13 photographs. (Cambridge: University Press, 1908.) Price 4*s*. net.

"Camp-fires on Desert and Lava." By W. T. Hornaday. Pp. xx+366; with 72 illustrations (3 in colour) and 2 maps. (London: T. Werner Laurie, n.d.) Price 16*s*. net.

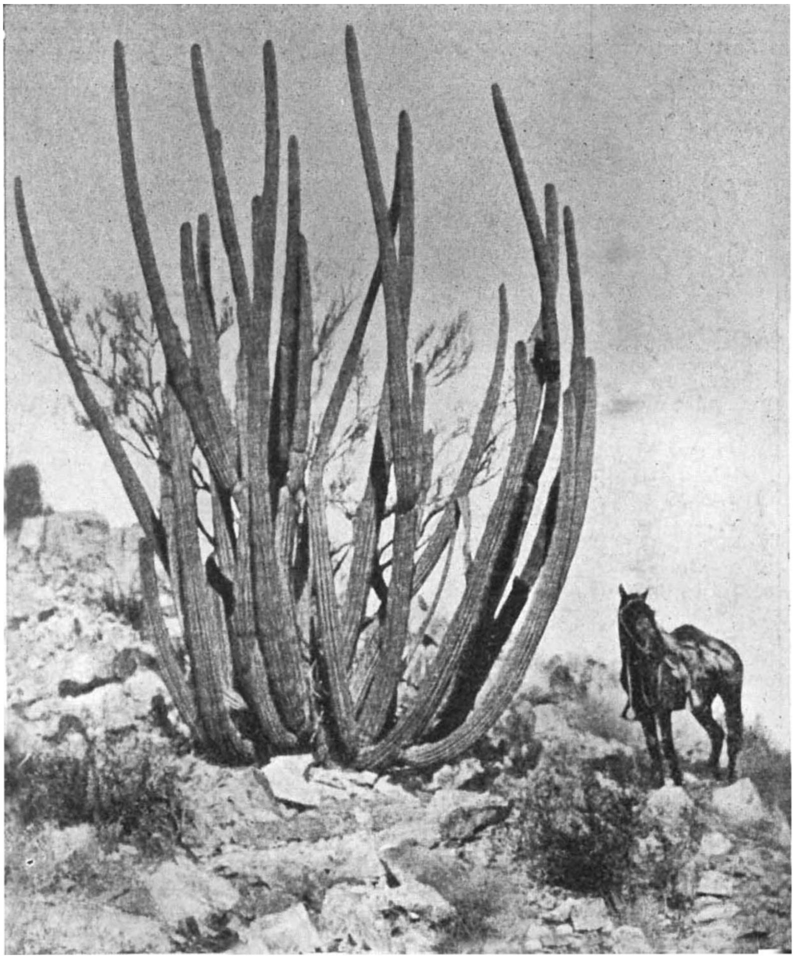


FIG. 2.—The Finest Organ-pipe Cactus. From "Camp Fires on Desert and Lava." Photograph by the author.

In "Camp-fires on Desert and Lava" the author gives a graphic account of the vegetation and animal life of the desert country in the extreme south-west of Arizona and the Mexican borderland. The book is a diary of a trip led by Dr. D. T. MacDougal, director of the recently formed Desert Botanical Laboratory at Tucson, Arizona. The ostensible object of the trip was the exploration of the unknown country round about Pinacate Peak, which lies between the international boundary and the Gulf of California. Mr. Godfrey Sykes, geographer to the expedition, supplies two new maps which show the route of the expedition and add considerably to geographical knowledge of the Pinacate district. But it is the naturalist and, above all, the botanist, who will find most of interest in the book.

Mr. Hornaday poses as Dr. MacDougal's pupil, but he has a keen eye for the plants, and has given as graphic an account as we have seen of the remarkable adaptations of plant-life to the almost waterless conditions of the sand-deserts or lava-strewn plains and mountains. The numerous excellent photographic illustrations are a great help towards realising the general ecological conditions of the district, as well as the habit of the components of its flora. The various Cacti, such as the giant cactus, or Saguaro (*Cereus giganteus*), the organ-pipe cactus (*Cereus Thurberi*) (Fig. 2), the Choya (Opuntia sp.), and the barrel cactus (Echinocactus), the Ocatilla (*Fouquiera splendens*)—"next to the giant cactus the most monumental and picturesque thing of plant growth found in two hundred miles of fertile deserts," when in full leaf resembling a bouquet of green wands held at the bottom by an invisible hand—the mesquite tree (*Prosopis velutina*)—the most persistent bush-tree of the deserts, the leaves and beans of which are eaten by horses and cattle when grass is not obtainable, while its wood is the general stand-by for fuel and almost the only available for house-building in the deserts of the south-west—and the *palo verde* (*Parkinsonia microphylla*), which, according to soil and water supply, varies from 3 feet to 15 feet in height—these and the many other characteristic xerophytes become very real to us from Mr. Hornaday's quite non-technical descriptions and the photographs taken by one or other of the party.

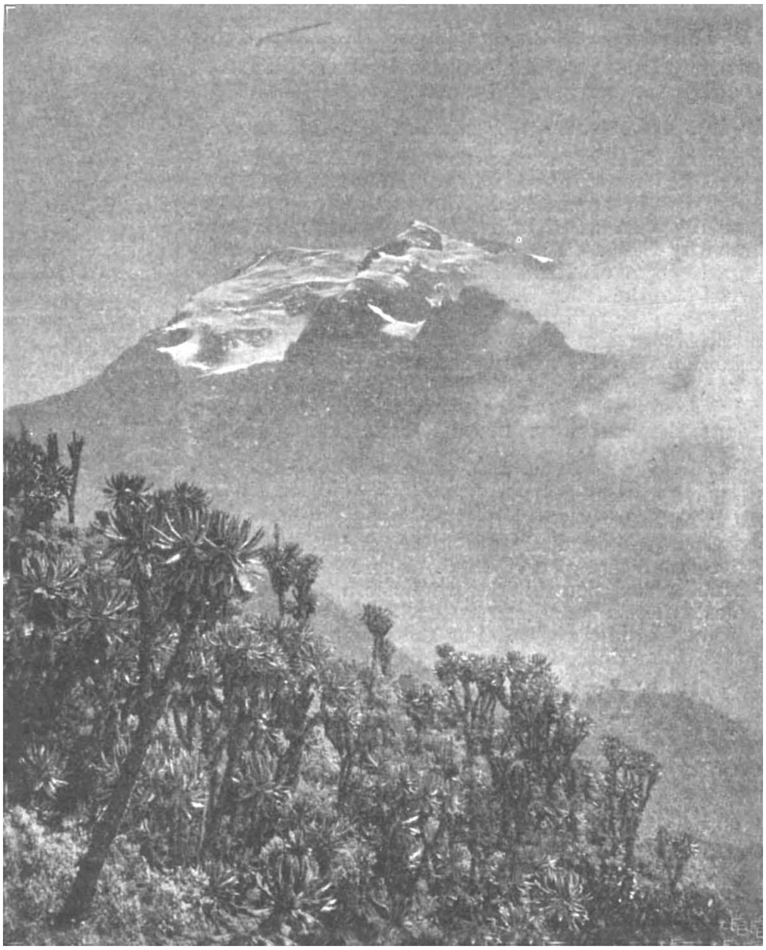
The author is also a sportsman, and the text has many interludes which will interest the sportsman rather than the botanist; and it would be unfair not to mention the numerous observations on animal-life, especially the valuable chapter on the mountain sheep of Mexico and the range of the species.

A. B. R.

THE MOUNTAINS OF THE MOON.[1]

EASTERN equatorial Africa has three mountain groups capped by perpetual snow—Kilimanjaro, Kenya, and Ruwenzori. Though the last is the lowest, and was the most recently discovered, it has aroused the widest popular interest; for its discoverer, Stanley, with characteristic insight, recognised it as "the Mountain of the Moon," the snows of which, according to the well-known passage in Ptolemy's "Geography," nourished the sources of the Nile. Ptolemy's general account of the Nile lakes is sufficiently accurate to show that he wrote from positive information. Otherwise, as Signor De Filippi remarks, he must have been gifted with prophetic insight. The statement about the Mountain of the Moon and its snows is, however, probably only an Arab interpolation; that view, so plausibly advanced by Cooley in 1854, is accepted as probable by Dr. Luigi Hugues in an appendix to this volume. Stanley's identification of Ruwenzori with Ptolemy's Mountain of the Moon has been, of course, called in question, but the alternative theories are as emphatically rejected in this work as in most of its predecessors.

Since the discovery of Ruwenzori by Stanley, the mountain has been repeatedly visited and partially explored. Stühlmann passed along its western side and took some fine photographs of the snow-capped peaks. Scott Elliot entered the range, saw some of its glaciers, and discovered that they were formerly more extensive. His observations and collections showed that instead of Ruwenzori having been volcanic, as had been suggested from analogy with Kilimanjaro and Kenya, it is a tilted block of Archean rocks left upstanding between the Victoria Nyanza basin and the rift valley of the Semliki. The later expeditions that visited the mountain found it usually shrouded in the clouds that had hidden it from Stanley's predecessor, Baker. The peaks could seldom be seen, but gallant attempts were made to reach them, as is duly recorded in Cav. De Filippi's narrative. Most of the expeditions added materially to our knowledge, and the repeated failures to achieve complete success tempted the Duke of the Abruzzi to undertake the exploration of Ruwenzori. He organised an expedition on a royal scale, judiciously selected the most favourable time of year, and the easy route by the Uganda Railway and steamer across the Victoria Nyanza. He left Entebbe, the capital of Uganda, on May 14, 1906, at the head of a caravan of 400 men, including a distinguished scientific staff, a company of Swiss guides and porters, and the great mountain photographer, Sella. Aided by the British officials, to whom warm thanks are expressed in the book, the Duke of the Abruzzi soon reached the eastern foot of the mountains, and established a light camp near the head of the valley, up which most of his predecessors had climbed to the Alpine regions of Ruwenzori. The expedition had been carefully equipped, and its resources were handled with the Duke's usual energy and courage. He overcame all obstacles, climbed all five of the ice-capped mountains, and most of the chief peaks; and his expedition returned with a series of mountain photographs unrivalled in African literature, a geological map of the main part of Ruwenzori, and detailed information as to its geography.



Mount Speke seen from the Senecio Forest at the foot of Scott Elliot's Col. From "Ruwenzori."

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[1] "Ruwenzori: an Account of the Expedition of H.R.H. Prince Luigi Amedeo of Savoy, Duke of the Abruzzi." By F. de Filippi. Pp. xvi+408; illustrations, plates, 5 maps. With a preface by H.R.H. the Duke of the Abruzzi. (London: A. Constable and Co., Ltd., 1908.) Price 31*s*. 6*d*. net.